(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 570 181 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
08.12.1999 Bulletin 1999/49

(51) Int Cl.[6]: **H01R 23/72**, H01R 23/68, H01R 13/74, H01R 23/70, H01R 13/633

(21) Application number: **93303601.4**

(22) Date of filing: **10.05.1993**

(54) **High frequency electrical connector**

Elektrischer Verbinder für Hochfrequenz

Connecteur électrique de haute fréquence

(84) Designated Contracting States:
DE FR GB NL

(30) Priority: **11.05.1992 GB 9210119**
11.05.1992 GB 9210131

(43) Date of publication of application:
18.11.1993 Bulletin 1993/46

(73) Proprietor: **THE WHITAKER CORPORATION**
Wilmington, Delaware 19808 (US)

(72) Inventors:
- **Soes, Lucas**
  NL-5248 BB Rosmalen (NL)
- **Broeksteeg, Johannes**
  NL-5341 AG Oss (NL)

(74) Representative: **Warren, Keith Stanley et al**
BARON & WARREN
18 South End
Kensington
London W8 5BU (GB)

(56) References cited:
EP-A- 0 442 643
EP-A- 0 458 483
DE-A- 2 736 079
DE-A- 2 801 427
DE-A- 3 426 783
DE-B- 2 242 258
FR-A- 2 123 622
FR-A- 2 489 609
FR-A- 2 661 048
US-A- 3 576 520
US-A- 4 032 209
US-A- 4 984 992
US-A- 5 057 038

EP 0 570 181 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The subject invention relates to a high frequency electrical connector and, more particularly, to such a connector which may be used in an electrical connector system interconnected to a backpanel interconnectable with a daughter board electrical connector system.

[0002] A daughter board electrical connector is shown in EP-A-0 422 785, which is interconnectable to a pin header which mounts on a back panel. It is also advantageous to extend the pins of the above mentioned header entirely through the back panel, and to provide a cable connection to it. One of the difficulties encountered is that variable lengths of connections are required, and thus the system must be modular in nature. Moreover, this system is on a rather small grid, 2mm x 2mm, and thus these cable connections must be easily accessible and useable by the end user.

[0003] It is advantageous in this system to have the provision for connecting coax or twinax cable connectors thereto, and an object of the invention is to provide for a twinaxial cable connector where the signal contacts are shielded, thereby separating the pairs of twinaxial cables into differential pairs.

[0004] The invention consists in a high frequency electrical connector for twinaxial or coaxial cable having at least one signal conductor and a shielding braid surrounding the signal conductor characterized by

an insulative housing comprising at least two signal contact carrying passageways separated by a ground contact carrying passageway, at least two signal carrying contacts positioned in the respective passageways and each having a contact portion for mating with a complementary connector and a connection portion for connecting with a signal conductor, and shielding at least partially surrounding said housing and comprised of at least upper and lower plate portions, wherein at least one of the upper and lower plate portions includes a contact portion for connection with the ground shield of the cable, said upper and lower plate portions include shielding portions above and below the passageways, and one of said upper and lower plate portions includes an integral contact part positioned in said ground contact carrying passageway.

[0005] In order that the present invention may be more readily understood, reference will now be made to the accompanying drawings, in which:-

Figure 1 is an isometric view of a daughter board electrical connector poised for receipt with a pin field on a backpanel, and the backpanel cable interconnection system positioned on the backpanel;
Figure 2 is an enlarged view of the cable connector shown in Figure 1;
Figure 3 is an isometric view of the mounting rail shown in Figure 1;
Figure 4 is an isometric view from the lower surface of the mounting rail shown in Figure 3;
Figure 5 is an isometric view of the rail prior to forming the vertical upstanding side walls of the mounting rail;
Figure 6 is an enlarged section of the mounting rail as shown in Figure 5;
Figure 7 is a view showing how the mounting rail as shown in Figure 5 can be stored on a reel for subsequent forming into the mounting rail;
Figure 8 shows the alignment of one of the connector housings as shown in Figure 2 with the mounting rail;
Figure 9 shows the cable connector in a fully connected position with the mounting rail;
Figure 10 shows the disconnection of the connector shown in Figures 8 and 9;
Figure 11 shows an assembled view of a cable connector according to the invention and suitable for use in the connector assembly shown in Figure 1;
Figure 12 shows an inner housing part of the cable connector of Figure 11;
Figure 13 shows the inner housing portion of Figure 12 with outer shielding members positioned around the housing;
Figure 14 is a cross-sectional view through lines 14-14 of Figure 13;
Figure 15 is a cross-sectional view through lines 15-15 of Figure 13; and
Figure 16 is a view similar to that of Figure 11 showing the top cover portion partially disassembled.

[0006] With reference first to Figure 1, a backplane assembly is shown comprised of a daughter board connector 2 which is substantially similar to that shown in EP-A-0 422 785. The daughter board assembly 2 is comprised of a daughter board 6 having a plurality of connector housings 8 mounted thereto which are electrically connectable to header connectors 10 providing a pin field on both sides of a backplane 12. Pins extend through the back plane 12, such that a pin field is formed within the headers 10 for electrical connection with the daughter board connectors 8, and further comprise a pin field on the opposite side of the backplane 12 providing a pin field for the cable connector assembly 4.

[0007] The cable assembly 4 is comprised of a stamped and formed mounting rail 16 positioned over the pin field formed by the pins 14, together with a plurality of connector assemblies 18. With reference now to Figure 2, the individual connector assembly 18 will be described in greater detail. The connector 18 is comprised of an insulating housing shown generally at 20 having a lower mating face 22 and a rear cable receiving face 24. The housing 20 further comprises a side wall 26 and an opposite side wall 28. The housing 20 includes a notched section at 30 thereby defining a recessed surface 31 and a rib 32 generally extending

along one side edge of the side wall 26. The opposite side includes a notched section 34 for clearance purposes as will be described herein, thereby defining a lower alignment edge 36. The housing 20 further includes two latch arms 38 integrally formed with the connector housing 20 and being moveable towards and away from each other, the two latch arms 38 being formed with a side seam shown at 40, and being hinged at a lower section 42. Each latch arm 38 includes a latching lug portion 44 for locking the connector 18 in position within the mounting rail 16. The latch arms 38 are moveable to an unlocked position by way of a release mechanism shown generally at 46 comprised of a mylar strip 48 which extends through apertures 50 adjacent to the free ends of the latch arms 38, such that upward movement of the mechanism 46 pulls the arms towards each other thereby moving the locking lugs 44 inwardly for releasement.

[0008] In a preferred embodiment, the connector 18 is profiled as a 20 position connector, having four rows of five contacts across, and therefore the front mating face 22 has corresponding pin receiving openings for receiving the pins 14 of the backplane connector 12. Two ten-conductor cables 52 and 54 extend through corresponding openings 56 and 58 through the rear cable receiving face 24 for electrical connection with electrical contacts in the connector 18. It should be appreciated that the cable receiving openings 56 and 58 are offset from the center line of the connector such that it does not interfere with the operation of the mylar strip 48 which extends between the latching arms 38.

[0009] With respect now to Figures 3 and 4, the mounting rail 16 is shown in greater detail. The mounting rail 16 is in the preferred embodiment stamped and formed from a flat strip of metal material to comprise a lower mounting plate 60 and two upright vertical walls 62 and 64. The lower mounting plate 60 comprises mounting apertures 63 for mounting the rail 16 to the backplane 12 as shown in Figure 1. The lower mounting surface 60 further includes a plurality of openings at 66 (Figure 4) which provide access for the pins 14 (Figure 1) to extend upwardly therethrough. It should be appreciated from Figure 4 that the openings 66 are symmetrically positioned along the lower mounting face 60 separated by strap portions 68, although adjacent openings 66 could be joined by removing one or more of the strap portions, for example by severing the lower plate portion 60 at 70. Each side wall 62 and 64 contains a plurality of apertures 72 (Figure 3) which are profiled to receive the latching lugs 44 (Figure 2) of the cable connector 18.

[0010] As shown in Figure 3, the side wall 62 includes a stamped recess at 74 extending along the longitudinal length of the side wall 62 thereby defining an inner surface at 76. A plurality of slots 78 are stamped out of the side wall 62 positioned above the surface 76, whereas a plurality of ribs 80 are stamped from the side walls 62, but are not stamped free from the side wall, but rather extend in a co-planer manner with the surface 76. With reference still to Figure 3, the side wall 64 includes a stamped recess 84 providing an inner surface at 86. A plurality of ribs 88 are stamped free of the side wall 64 and extend upwardly in a co-planar arrangement with the side wall 64, thereby defining a plurality of continuous slots at 90.

[0011] In the preferred embodiment, the mounting rail 16 is stamped and formed in a flat strip and as shown in Figures 5-7, and can be taken up and stored on a reel 92, whereby the strip material shown at 16' can be dereeled and sheered into the appropriate length as shown in Figure 7.

[0012] With the mounting rail 16 and connector housing 18 as described above, the mounting rail 16 can be mounted to a backplane 12 as shown in Figure 1 with the pin field 14 of the header connector 10 extending therethrough and a plurality of cable connectors 18 can be interconnected to the daughter board assembly 2 via the pins 14. With reference to Figure 8, the cable connector 18 can be positioned above the mounting rail 16 with the rib 32 aligned with one of the slots 90 and with the rib 36 aligned with the slot 78. It should be appreciated that the inner surfaces 76 and 86 are profiled to receive the side surfaces 31 and 35 of the connector 18 while the connector 18 is aligned with the mounting rail 16 and the pins 14 by way of the ribs 32 and 36. As shown in Figure 9, the connector 18 is fully inserted in the mounting rail 16 with the ribs 36 and 32 positioned in corresponding slots 78 and 90 (Figure 8). In this position, the locking lugs 44 are latched into position with the apertures 72 on the side walls of the mounting rail 16. It should be appreciated that the connector 18 is easily disconnected from the mounting rail 16 and from the backplane assembly via pulling the release mechanism 46 in the direction of arrow A (Figure 10) which moves the latching arms 38 inwardly thereby releasing the latching lugs 44 from the corresponding apertures 72. It should be appreciated that the release mechanisms 46 provide great ease in disconnecting the cable connector 18 from the back panel.

[0013] It should also be appreciated that by stamping the mounting rail 16 into a longitudinal length of flat strip 16', that the mounting rail can be produced easily and inexpensively yet provide all the features necessary for mounting and aligning the various connectors 18. It should be appreciated that any number of longitudinal lengths will be required housing any number of connector assemblies 18. If the mounting rail 16 were moulded from a plastic material, several different mould cavities will be required to mould the various lengths, while extruding the mounting rail for plastic material could not provide the alignment features necessary for the connector.

[0014] With reference now to Figures 11-15, a high frequency connector according to the invention for use with the outer housing 20 (Figure 2) will be described. With respect to Figure 11, the cable connector includes an inner housing assembly comprised of a lower cover

part 116 having a front mating face 118 having a plurality of pin receiving openings at 120. The connector 118 further comprises an upper cover part 122 having a plurality of pin receiving openings at 124. The complementary covers 116 and 122 cooperatively provide cable receiving openings through a rear face, such as at 126.

[0015] With respect now to Figure 12, an inner insert housing portion is shown at 130 comprising a front face 132 having pin receiving openings shown generally at 134, and terminal receiving channels such as 136 and 138 positioned on upper 40 and lower 42 surfaces thereof. With reference still to Figure 12, a central channel 145 is defined between side walls 146 and 148 which provides a communication with the center pin receiving opening at 134c. As shown in Figure 12, the inner housing portion 130 is interconnected to two twinaxial cables 52' and 54' comprised of an outer insulative portion 152 having a shielded section at 154 and two twinaxial cable pairs: 156a, 156b, 156d, 156e. It should be appreciated from Figure 12 that the two twinaxial signal conductors 156a and 156b are in alignment with the pin receiving openings 134a and 134b respectively, whereas twinaxial signal conductors 156d and 156e are in alignment with pin receiving openings 134d and 134e respectively. This leaves the center pin receiving opening 134c and the channel 145 empty.

[0016] With respect now to Figure 13, a shield member is shown generally at 160 comprised of upper plate portions 162 and 164 with rear connecting sections 166 and 168 in contact with the shield 154 of the twinax cables 52', 54'. It should be appreciated that this connection could be by soldering, welding, or by way of ferrule or similar clamp. Two contact members 168 and 170 extend forwardly from the plate portion 162 whereas two contact members 172 and 174 extend forwardly from the plate portion 164. The contacts 168 and 170 are defined by bifurcated contact arms, shown generally at 176 in Figure 13, which are positioned in two of the channels 136 whereas contacts 172 and 174 are positioned in the channels 136 above the pin receiving passageways 134d and 134e. A center ground tab 180 is stamped from a central plate section, intermediate plate portions 162 and 164, and includes an integral contact portion 182 as best shown in Figure 14. This contact tab portion is bent downwardly into the channel 145 and intermediate the walls 146 and 148, (Figure 13). As shown in Figure 14, the contact portion 182 is aligned with the pin receiving opening at 134c. As shown in Figures 13 and 14, the shielding further comprises a lower shield or plate portion 190, and side plate portions 192 and 194. The lower shield portion 190 has integral contact members 198-206 (Figure 13), identical to the integral contacts 168-174, the contact members being positioned in respective channels 138 (Figure 12).

[0017] With respect now to Figure 15, signal contacts 210 are shown connected to the signal conductor 157, where the signal conductor is positioned in passageway 134d. The contact 210 contains a connecting portion 212 for contact with the signal conductor 157, and a receptacle portion 214 for contact with a mating pin 14 on the pin field shown in Figure 1. It should be understood that each passageway 134a,b,d,e carries a terminal similar to contact 210, each separately connected to a respective conductor 156a,b,d,e. After the electrical connections are made as shown in Figures 13-14, the upper and lower cover parts 116 and 122 can be positioned over the inner insert housing portion 130 to encapsulate the shielded members, as shown in Figure 16.

[0018] Advantageously then, two separate differential pairs are fully shielded by way of the outer shield members together with the shielding contacts surrounding the signal contacts.

[0019] It should also be noted that the connector concept could also be used with three coaxial cables, where the signal conductors are aligned with passageways 134a, 134c, 134d; and where the upper shield has a contact similar to 180, 182 extending into cavities 134b, 134d, through channels (similar to 145) positioned above the cavities 134b, 134d.

Claims

1. A high frequency electrical connector (118) for twinaxial (52',54') or coaxial cable (150) having at least one signal conductor (156a-156d) and a shielding braid (154) surrounding the signal conductor (157) characterized by

   an insulative housing (130) comprising at least two signal contact carrying passageways (134a,134b,134d, 134e), separated by a ground contact carrying passageway (134c), at least two signal carrying contacts (210) positioned in the respective passageways and each having a contact portion (214) for mating with a complementary connector and a connection portion (212) for connecting with a signal conductor (157), and shielding (160) at least partially surrounding said housing (130) and comprised of at least upper (162,164) and lower (190) plate portions, wherein at least one of the upper and lower plate portions includes a contact portion (166,168) for connection with the ground shield of the cable, said upper (162,164) and lower (190) plate portions include shielding portions above and below the passageways, and one of said upper and lower plate portions includes an integral contact part (182) positioned in said ground contact carrying passageway (134c).

2. A connector according to claim 1, wherein said integral contact part (182) is in the form of a bifurcated contact profiled for mating with a pin of the complementary connector.

3. A connector according to claim 1 or 2, wherein the housing (130) has a channel (145) between said at least two signal contact carrying passageways (134a,134b,134d,134e), and communicating with the ground contact carrying passageway (134c), said integral contact part (182) of the upper or lower plate portion extending into the ground contact carrying passageway via said channel.

Patentansprüche

1. Elektrischer Hochfrequenzverbinder (118) für zweiaxiale (52', 54') oder Koaxialkabel (150) mit mindestens einem Signalleiter (156a - 156d) und einer den Signalleiter (157) umgebenden abschirmenden Litze (154), gekennzeichnet durch

   ein Isoliergehäuse (130), das folgendes umfaßt: mindestens zwei Signalkontaktführungsdurchgänge (134a, 134b, 134d, 134e), die durch einen Erdkontaktführungsdurchgang (134c) voneinander getrennt sind, mindestens zwei Signale führende Kontakte (210), die in den jeweiligen Durchgangen angeordnet sind und jeweils ein Kontaktstück (214) zum Zusammenstecken mit einem Gegenverbinder und ein Verbindungsstuck (212) zum Anschließen an einen Signalleiter (157) aufweisen, und eine das Gehause (130) mindestens teilweise umgebende Abschirmung (160), die mindestens ein oberes (162, 164) und unteres (190) Plattenstück umfaßt, wobei von den oberen und unteren Plattenstücken mindestens einer ein Kontaktstück (166, 168) zum Anschluß an die Erdabschirmung des Kabels enthält, wobei die oberen (162, 164) und unteren (190) Plattenstücke über und unter den Durchgangen Abschirmungsstücke enthalten und von den oberen und unteren Plattenstücken einer einen integralen Kontaktteil (182) enthalt, der in dem Erdkontaktführungsdurchgang (134c) positioniert ist.

2. Verbinder nach Anspruch 1, bei dem der integrale Kontaktteil (182) in Form eines gegabelten Kontakts vorliegt, der zum Zusammenstecken mit einem Stift des Gegenverbinders profiliert ist.

3. Verbinder nach Anspruch 1 oder 2, bei dem das Gehäuse (130) zwischen den mindestens zwei Signalkontaktführungsdurchgängen (134a, 134b, 134d, 134e) einen mit dem Erdkontaktführungsdurchgang (134c) in Verbindung stehenden Kanal (145) aufweist, wobei sich der integrale Kontaktteil (182) des oberen oder unteren Plattenstücks über den Kanal in den Erdkontaktführungsdurchgang erstreckt.

Revendications

1. Connecteur électrique à haute fréquence (118) pour un câble twinaxial (52', 54') ou coaxial (150) possédant au moins un conducteur (156a-156d) de signaux et une tresse de blindage (154) entourant le conducteur (157) de signaux, caractérisé par

   un boîtier isolant (130) comprenant au moins deux passages (134a, 134b, 134d, 134e) porteurs de contacts pour signaux, séparés par un passage (134c) porteur d'un contact de masse, au moins deux contacts (210) porteurs de signaux positionnés dans les passages respectifs et présentant chacun une portion de contact (214) en vue d'un accouplement avec un connecteur complémentaire et une portion de connexion (212) en vue d'une connexion avec un conducteur (157) de signaux, et un blindage (160) entourant au moins partiellement ledit boîtier (130) et constitué d'au moins des portions de plaquette supérieure (162, 164) et inférieure (190), dans lequel au moins l'une des portions de plaquette supérieure et inférieure comporte une portion de contact (166, 168) en vue d'une connexion avec le blindage de masse du câble, lesdites portions de plaquette supérieure (162, 164) et inférieure comportent des portions de blindage au-dessus et en dessous des passages, et l'une desdites portions de plaquette supérieure et inférieure comporte une pièce de contact intégrale (182) positionnée dans ledit passage (134c) porteur du contact de masse.

2. Connecteur selon la revendication 1, dans lequel ladite pièce de contact intégrale (182) prend la forme d'un contact en fourche profilé pour s'accoupler avec une broche du connecteur complémentaire.

3. Connecteur selon la revendication 1 ou 2, dans lequel le boîtier (130) présente un canal (145) situé entre lesdits au moins deux passages (134a, 134b, 134d, 134e) porteurs de contacts pour signaux et communiquant avec le passage (134c) porteur du contact de masse, ladite pièce de contact intégrale (182) de la portion de plaquette supérieure ou inférieure se prolongeant dans le passage porteur du contact de masse par le biais dudit canal.

Fig. 1

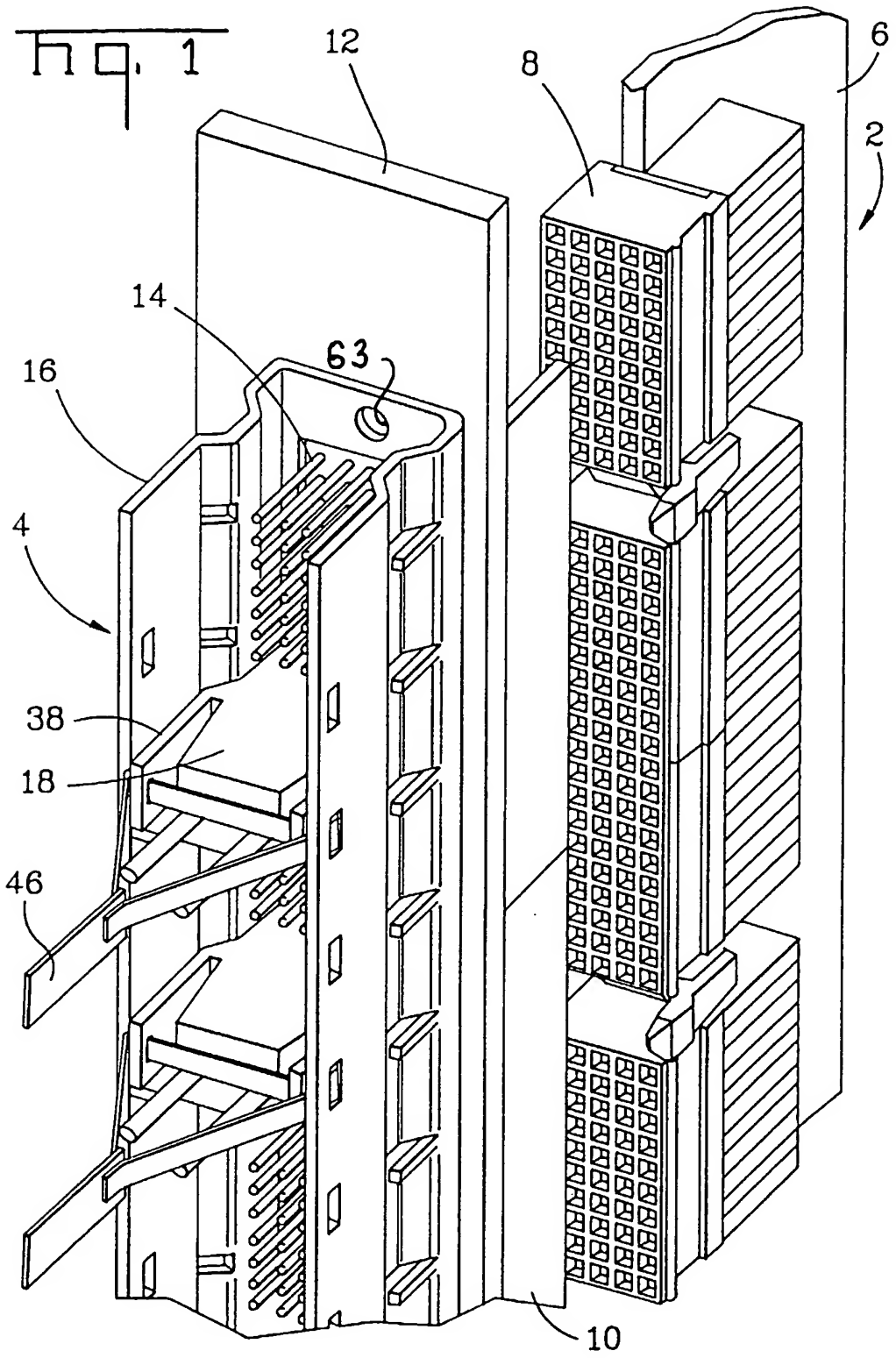
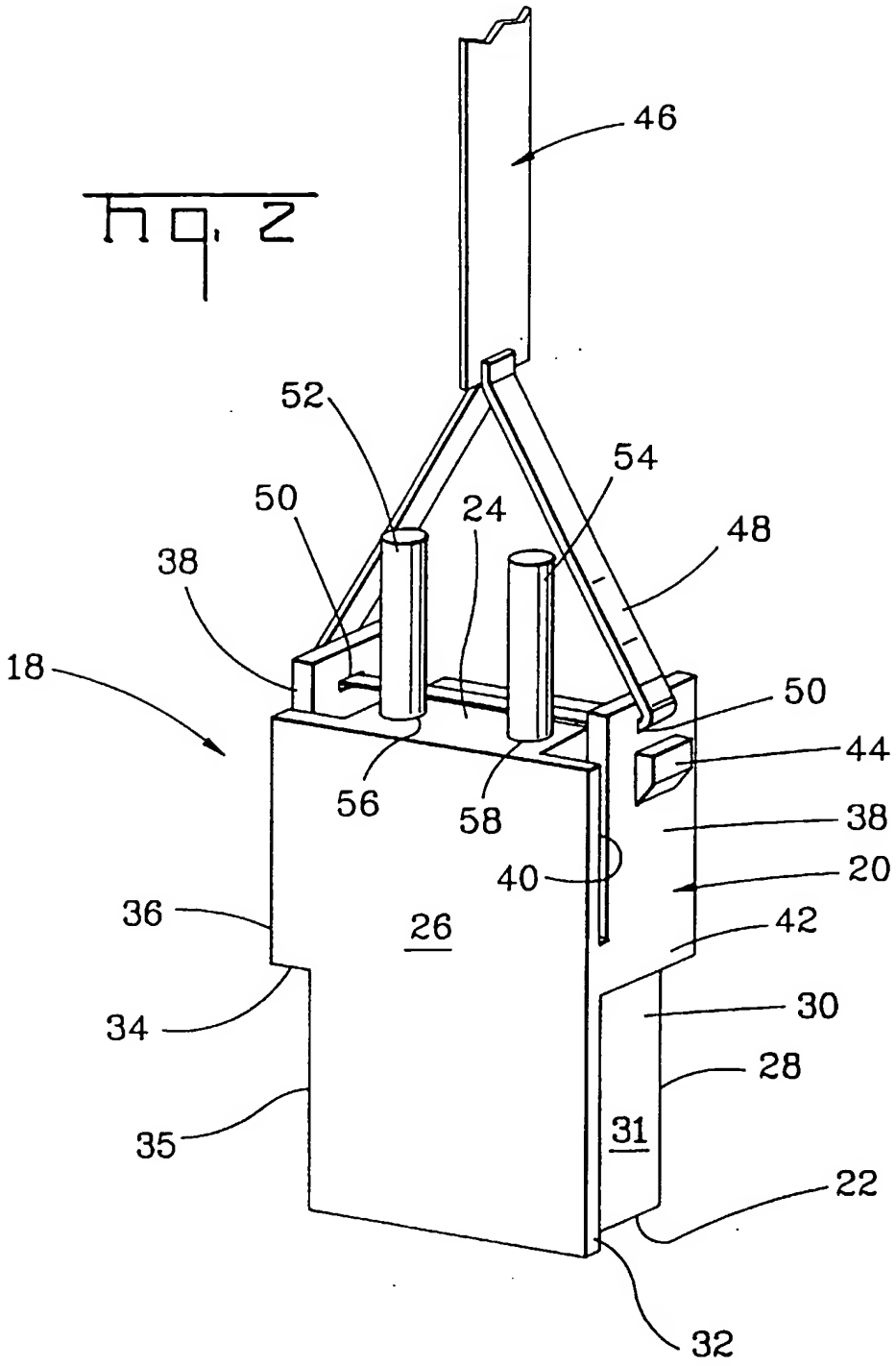


Fig. 2


46
52
54
50
24
48
38
18
50
44
56
58
38
40
20
36
26
42
30
34
28
35
31
22
32

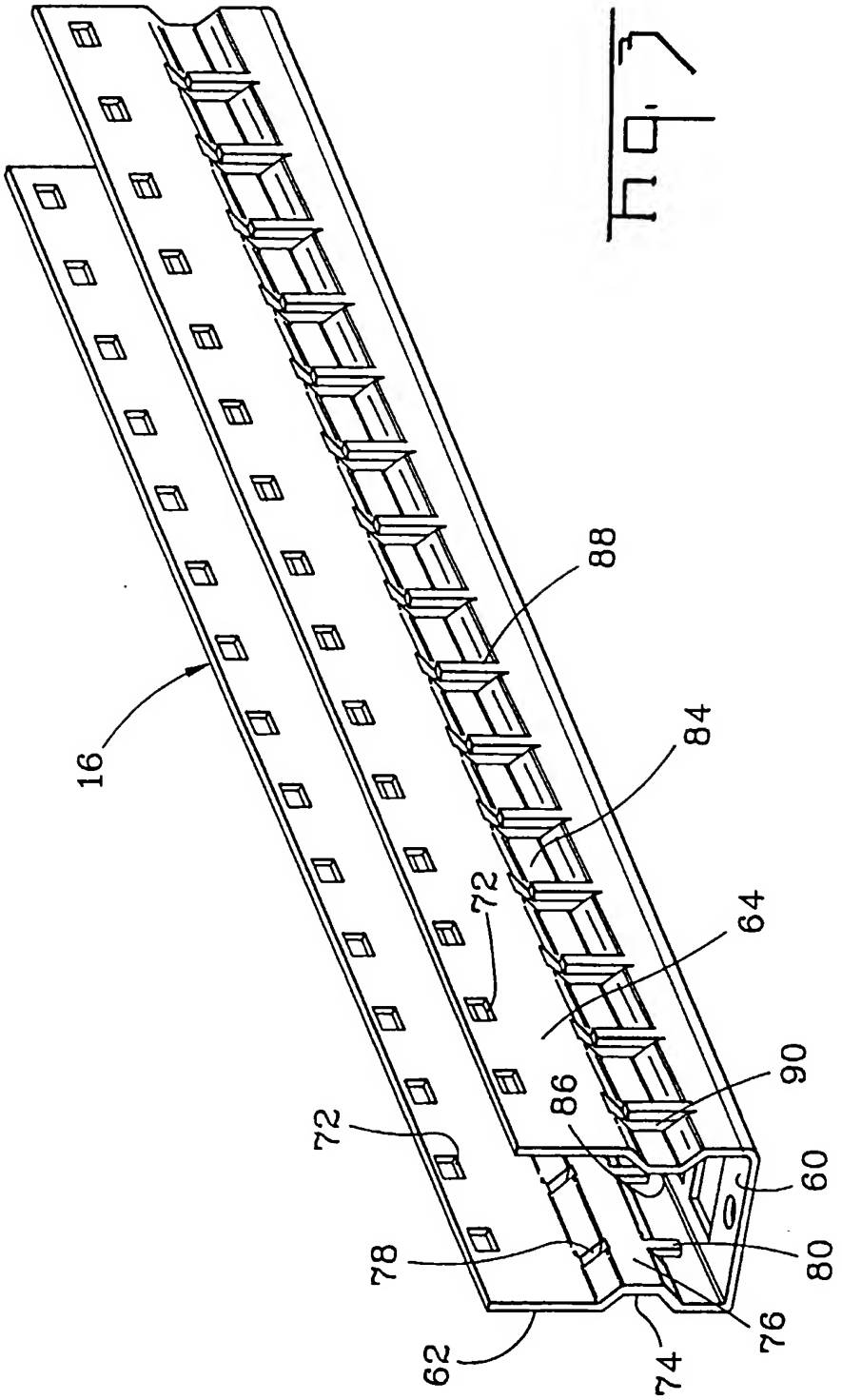


Fig. 3

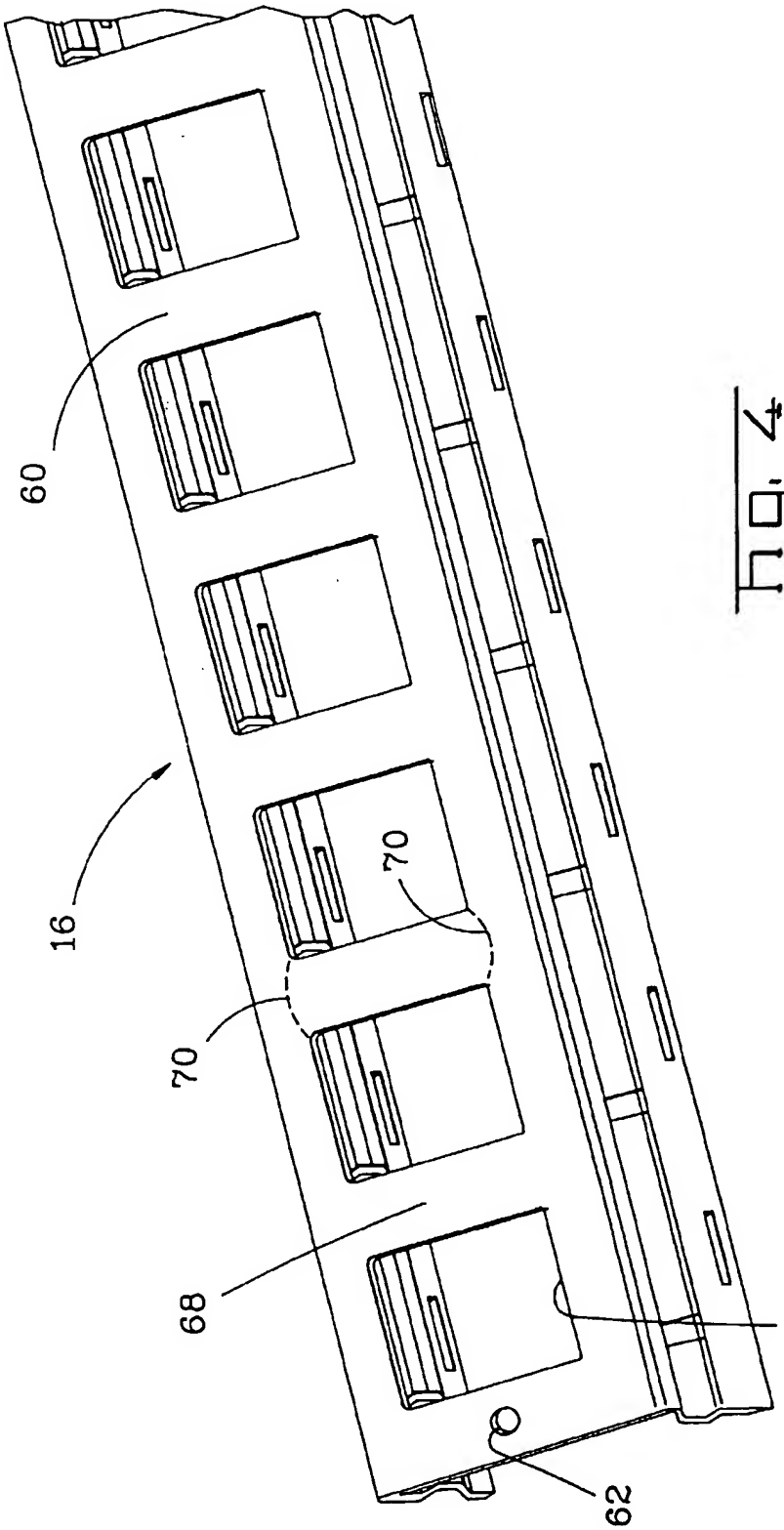


Fig. 4

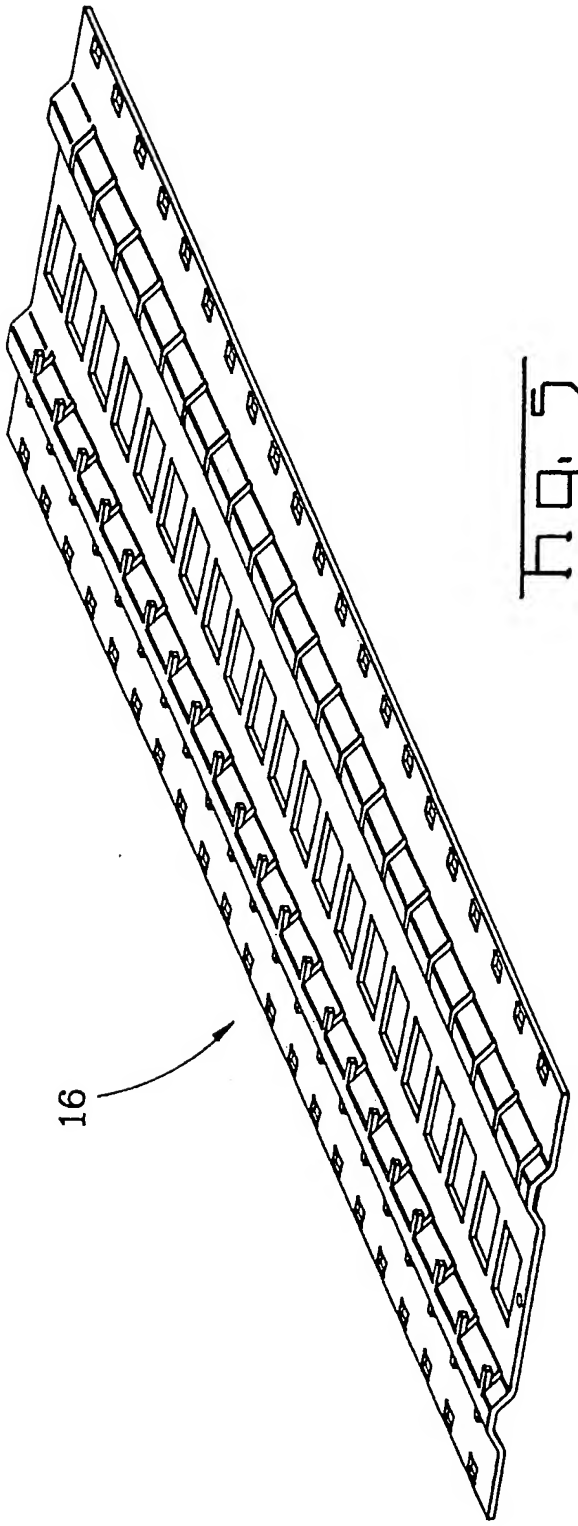


Fig. 5

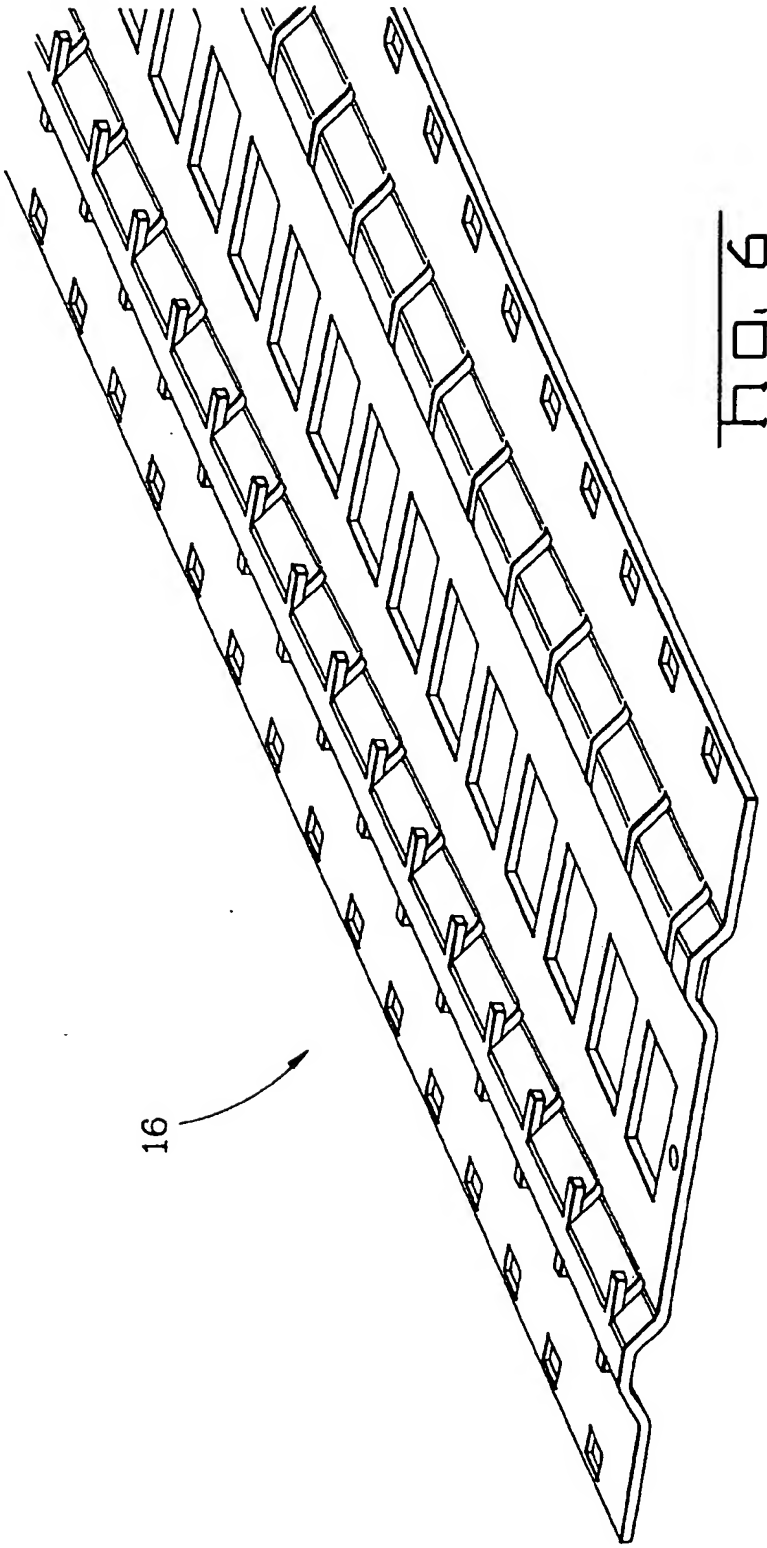


Fig. 6

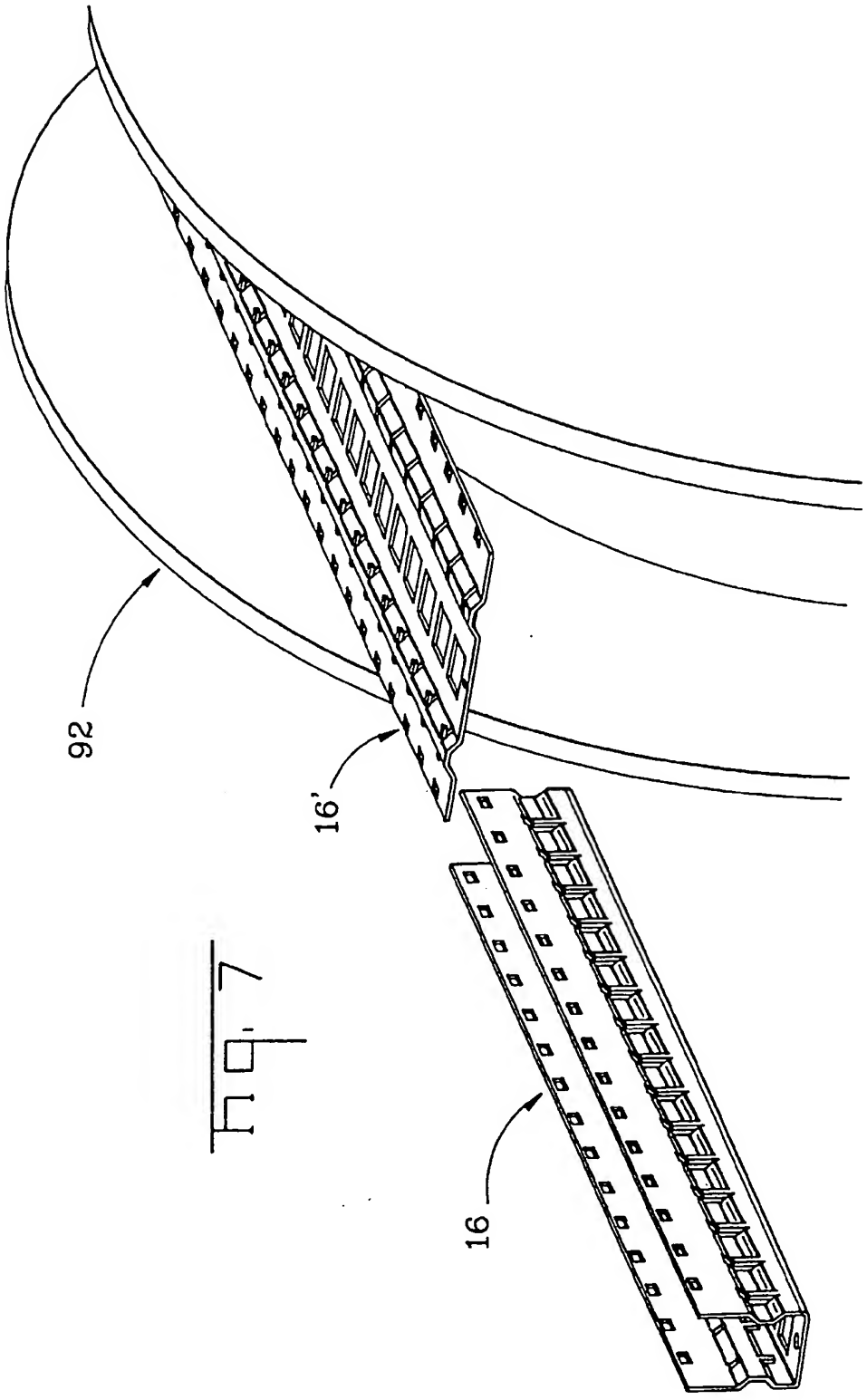


Fig. 7

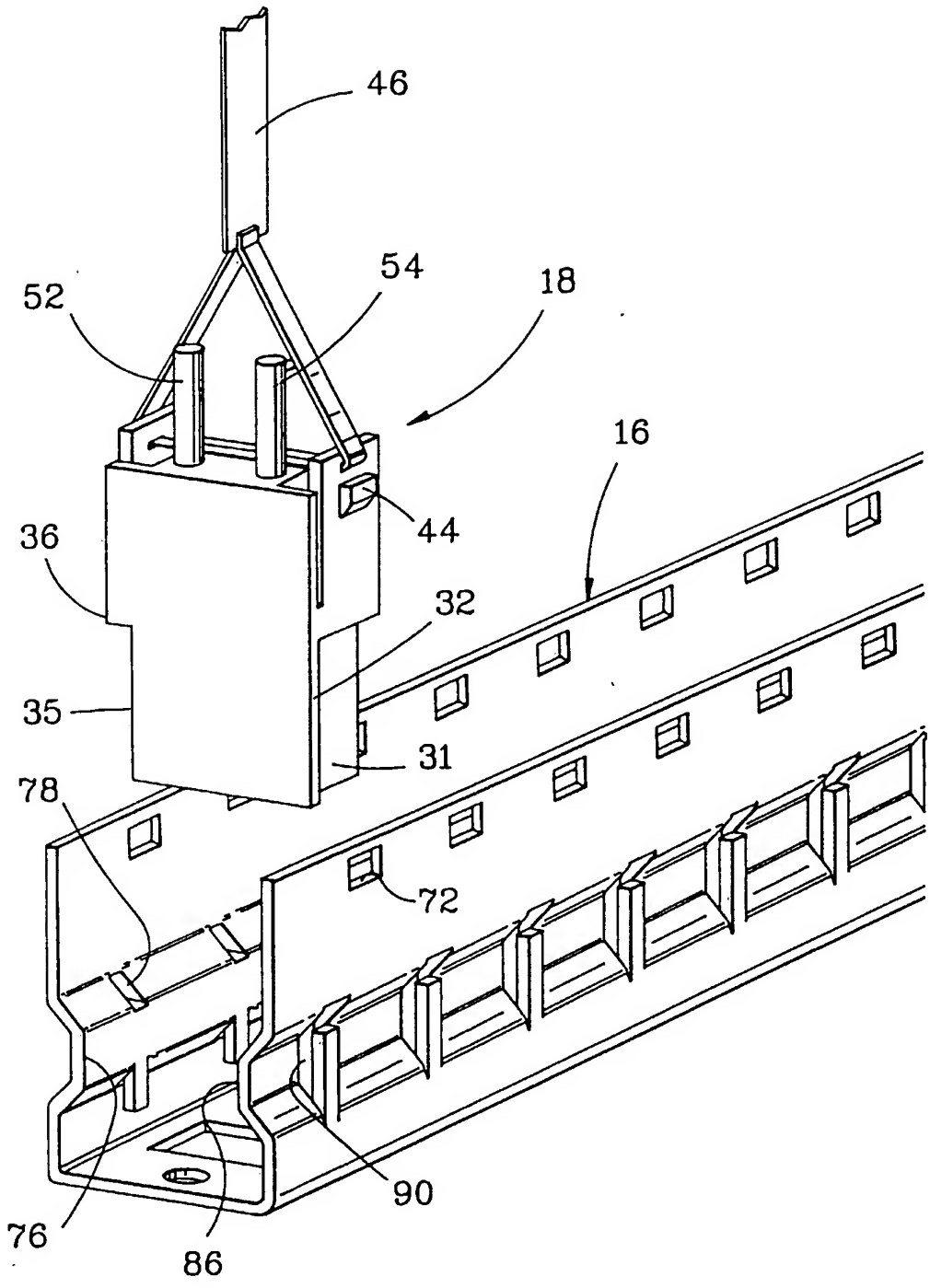


Fig. 8

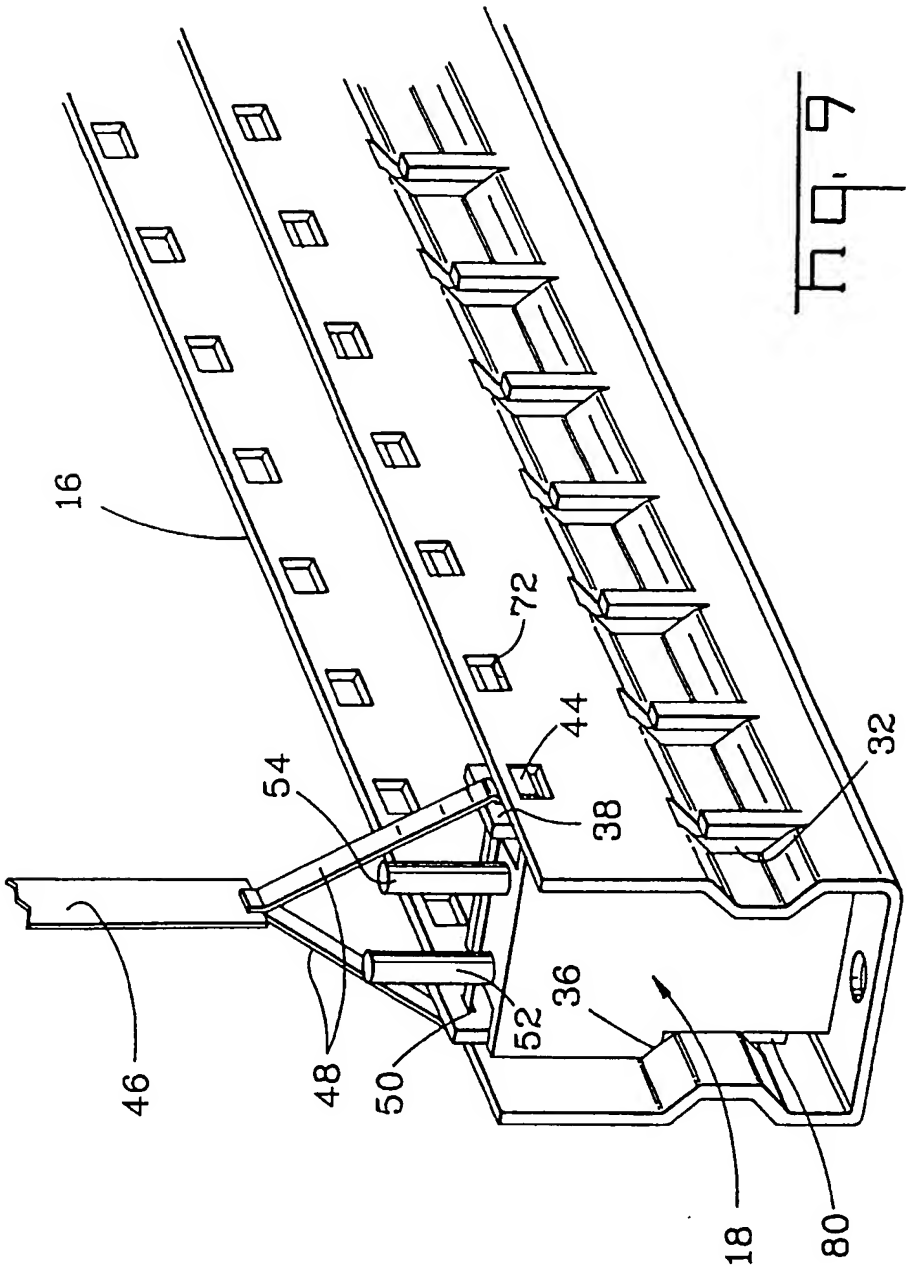


Fig. 9

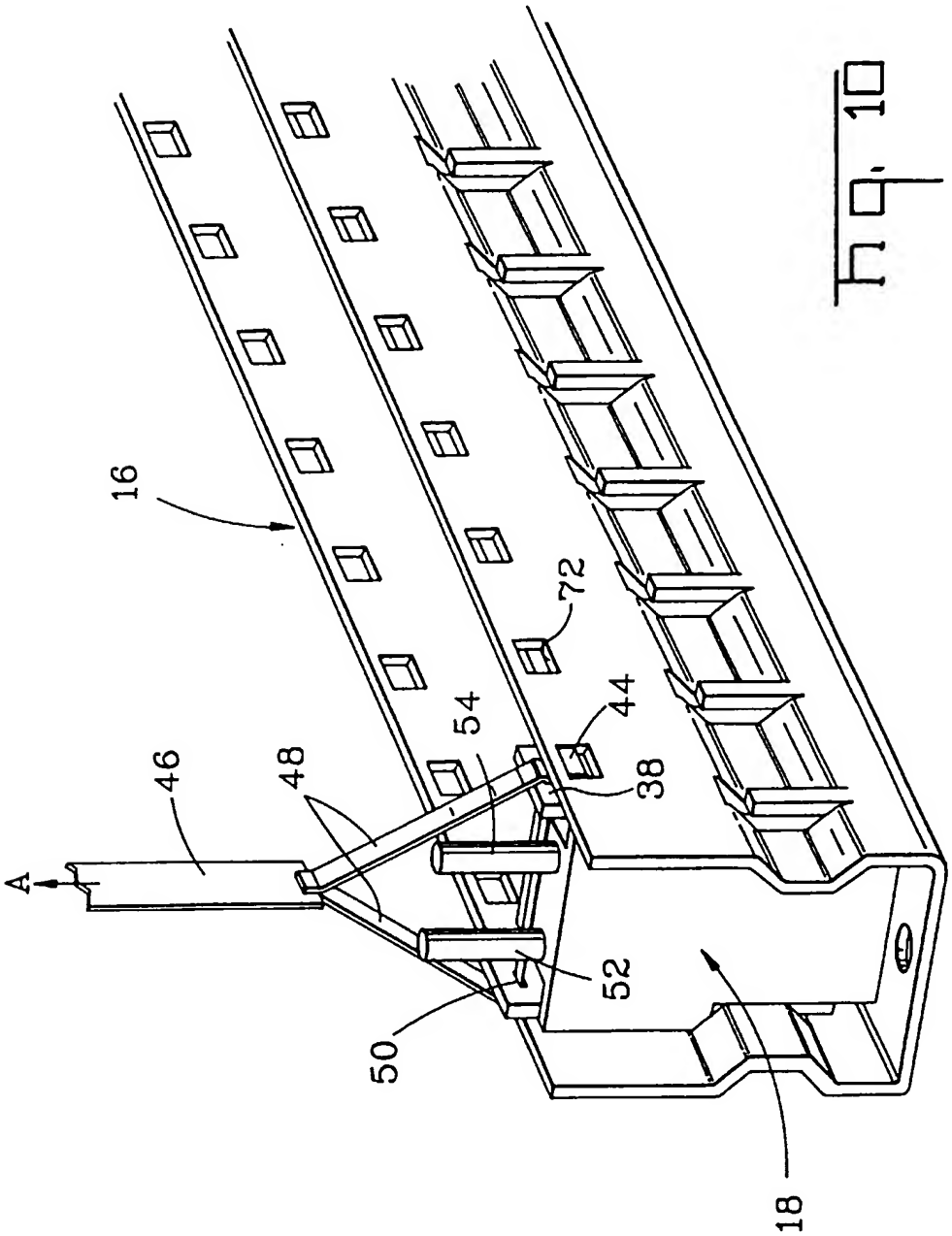


Fig. 10

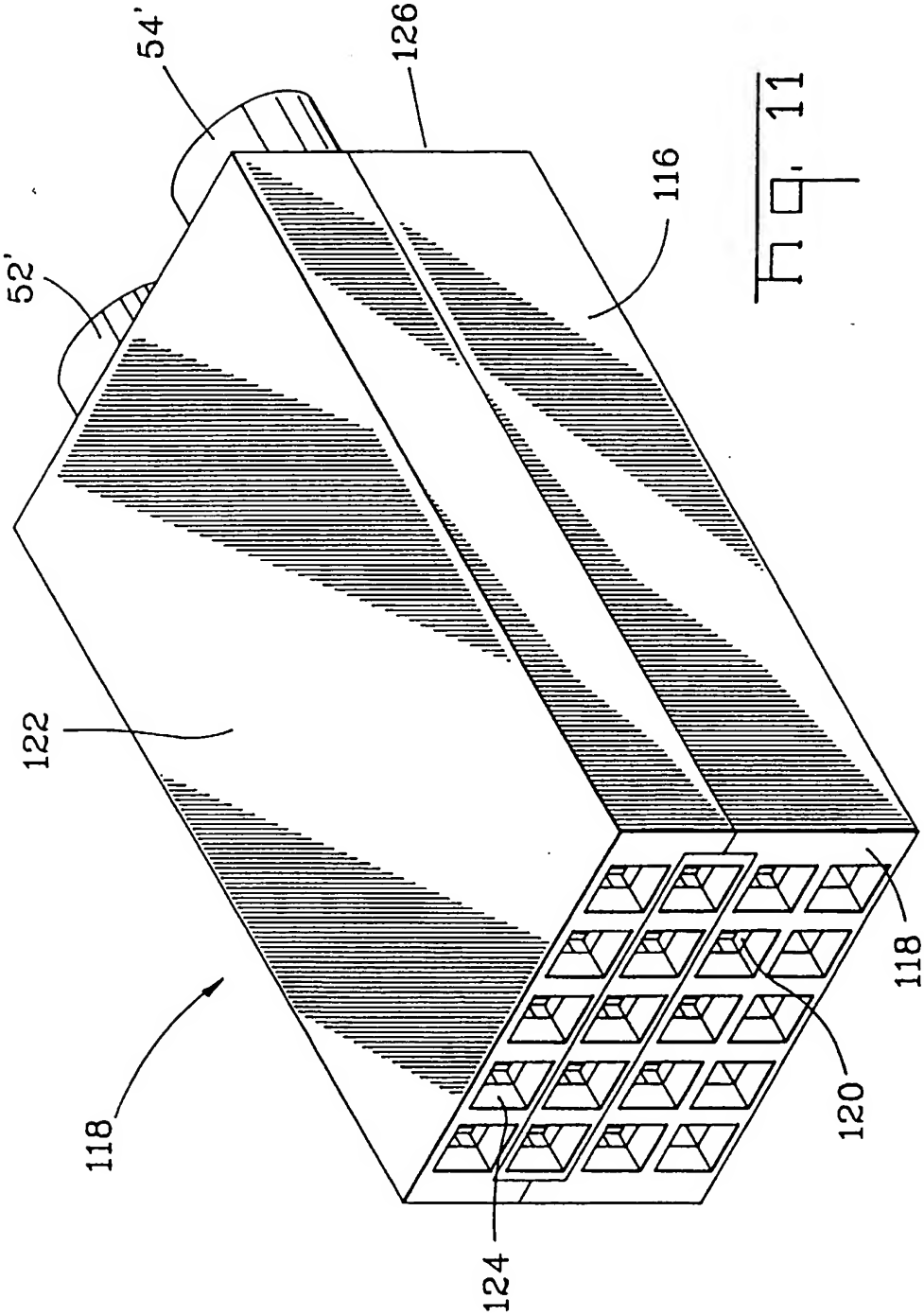


FIG. 11

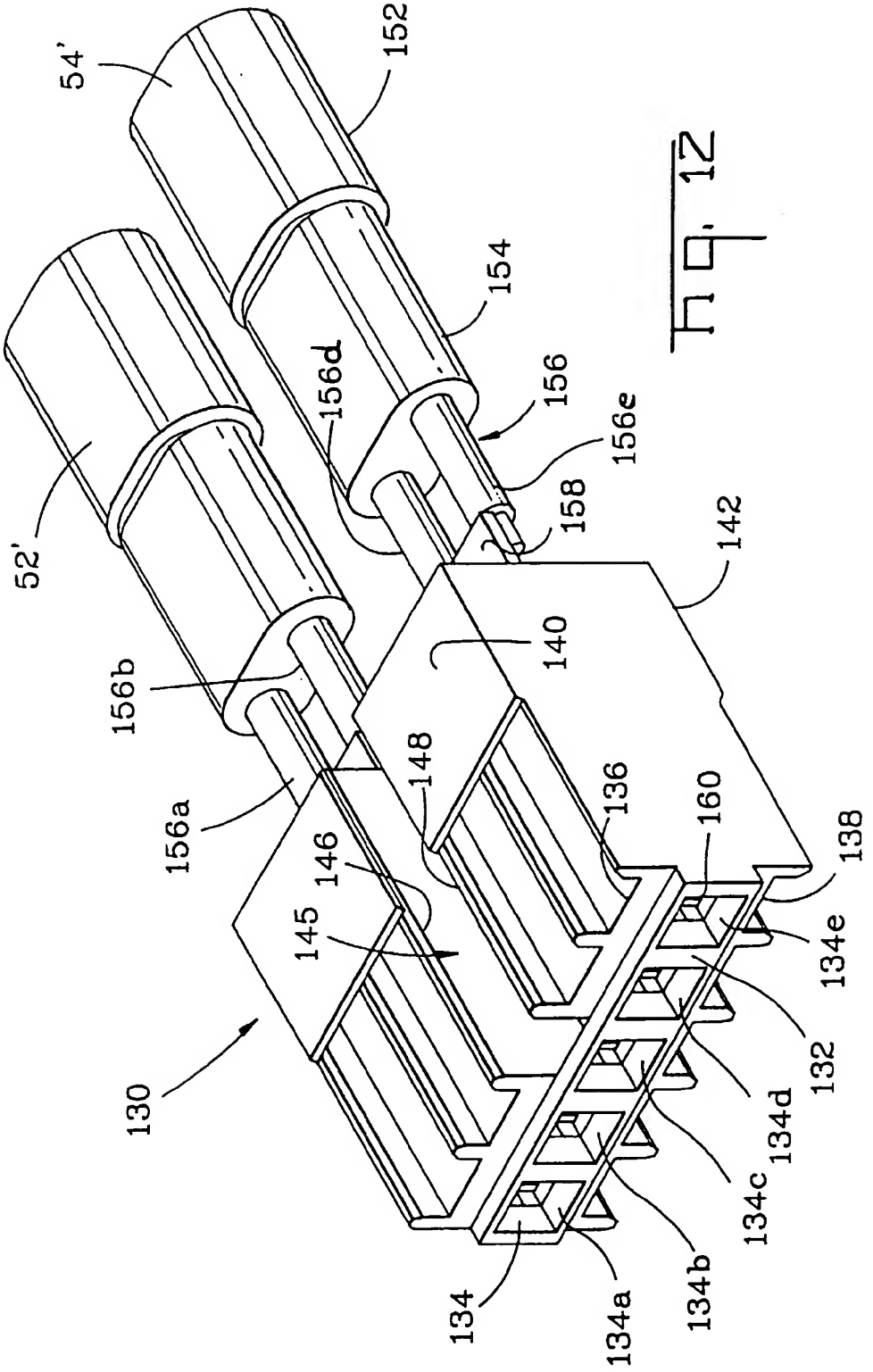

54'
152
154
156
156d
156e
158
52'
142
140
156b
148
136
160
138
156a
146
145
134e
132
130
134d
134c
134b
134a
134

Fig. 12

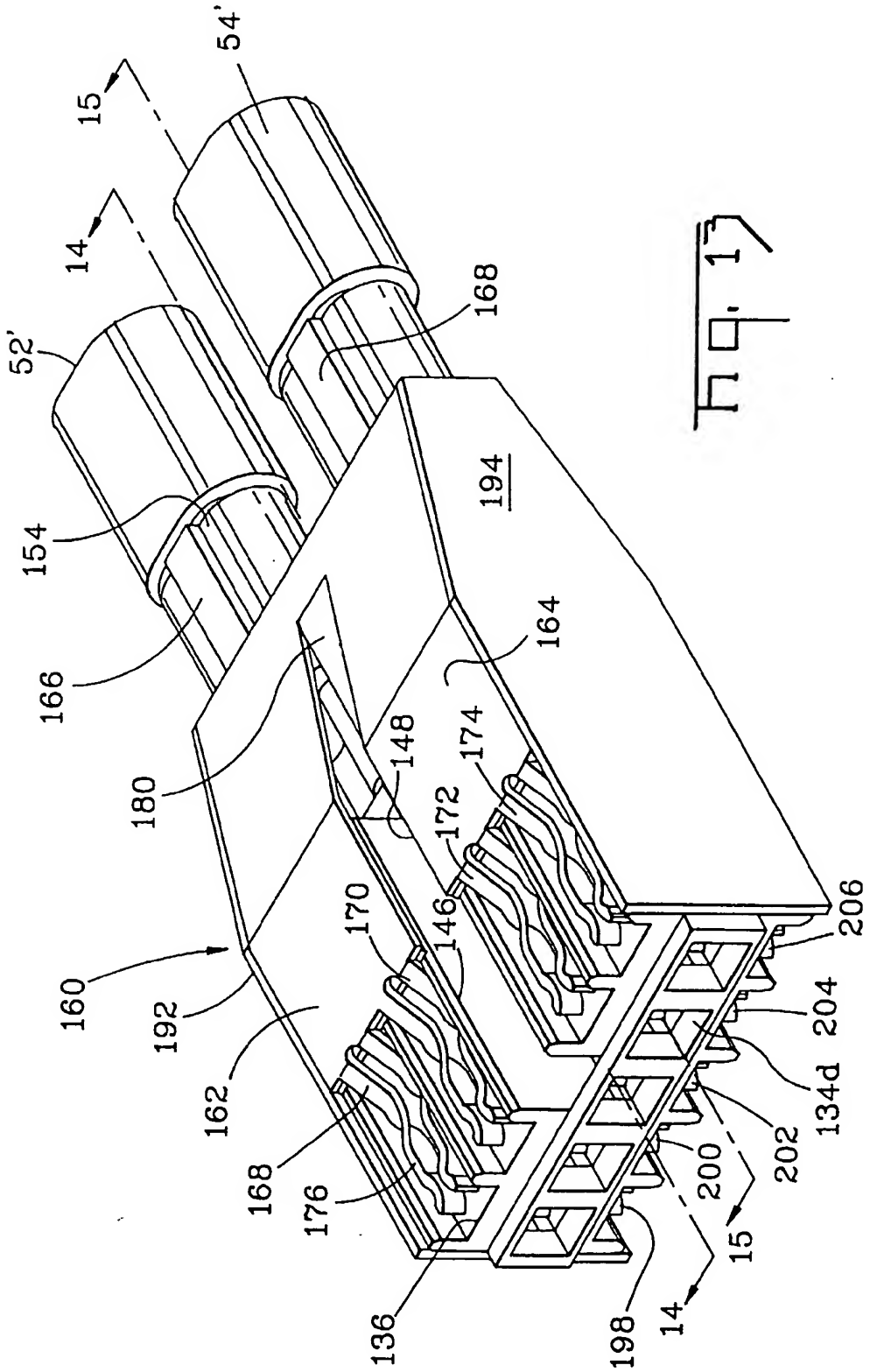

54'
15
14
52'
168
154
194
166
164
180
148
174
172
170
146
160
206
192
204
162
134d
168
202
176
200
15
136
198
14

Fig. 17

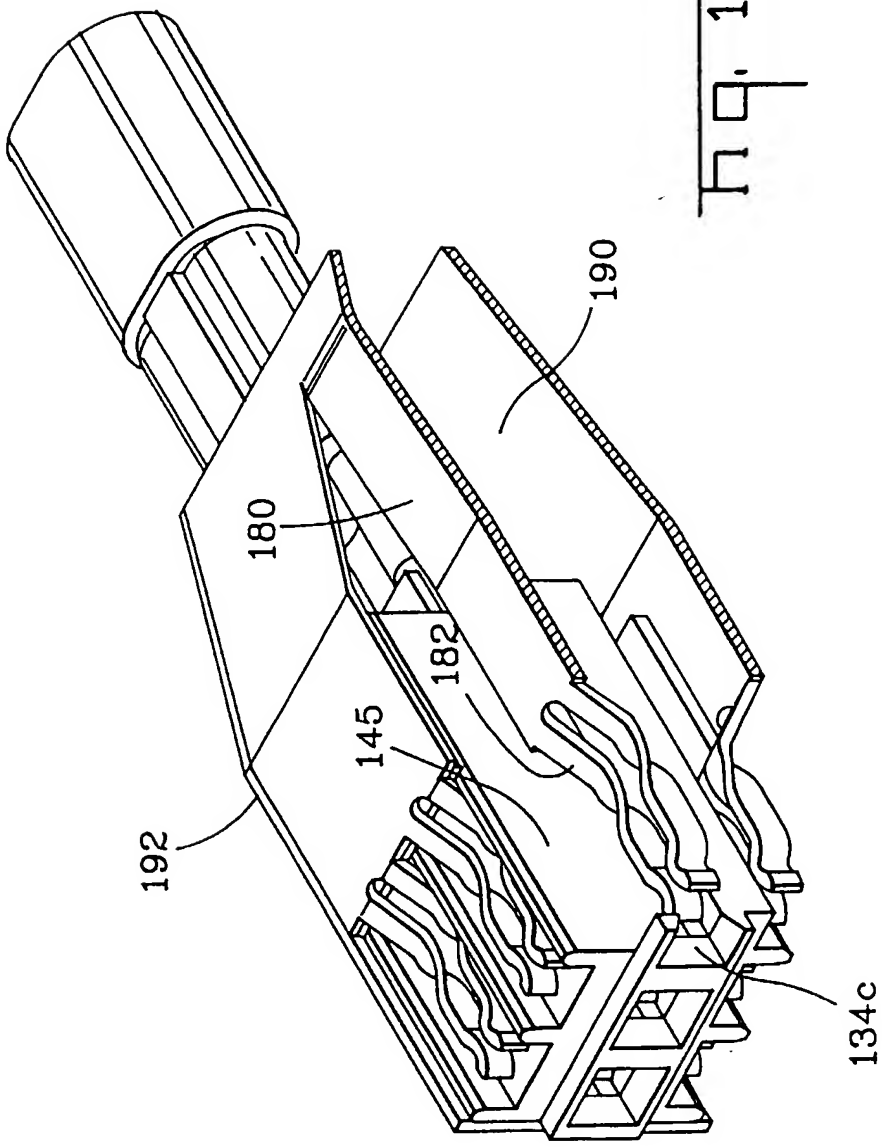


Fig. 14

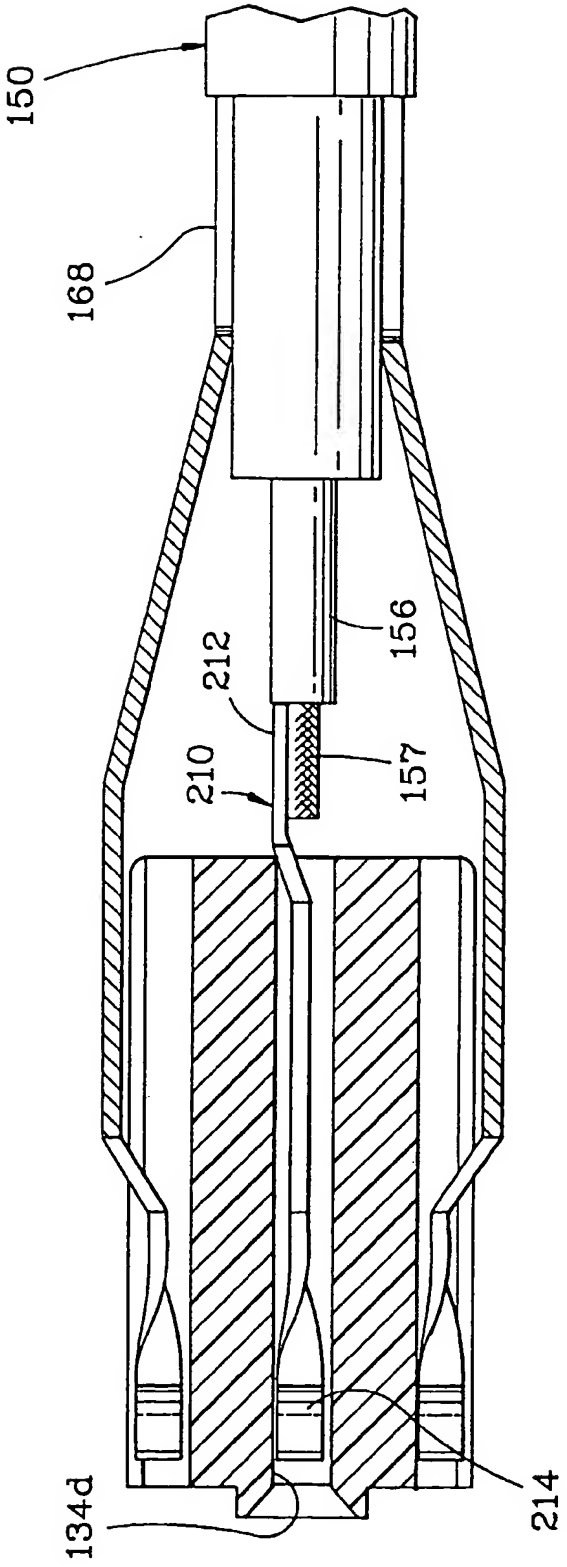


Fig. 15

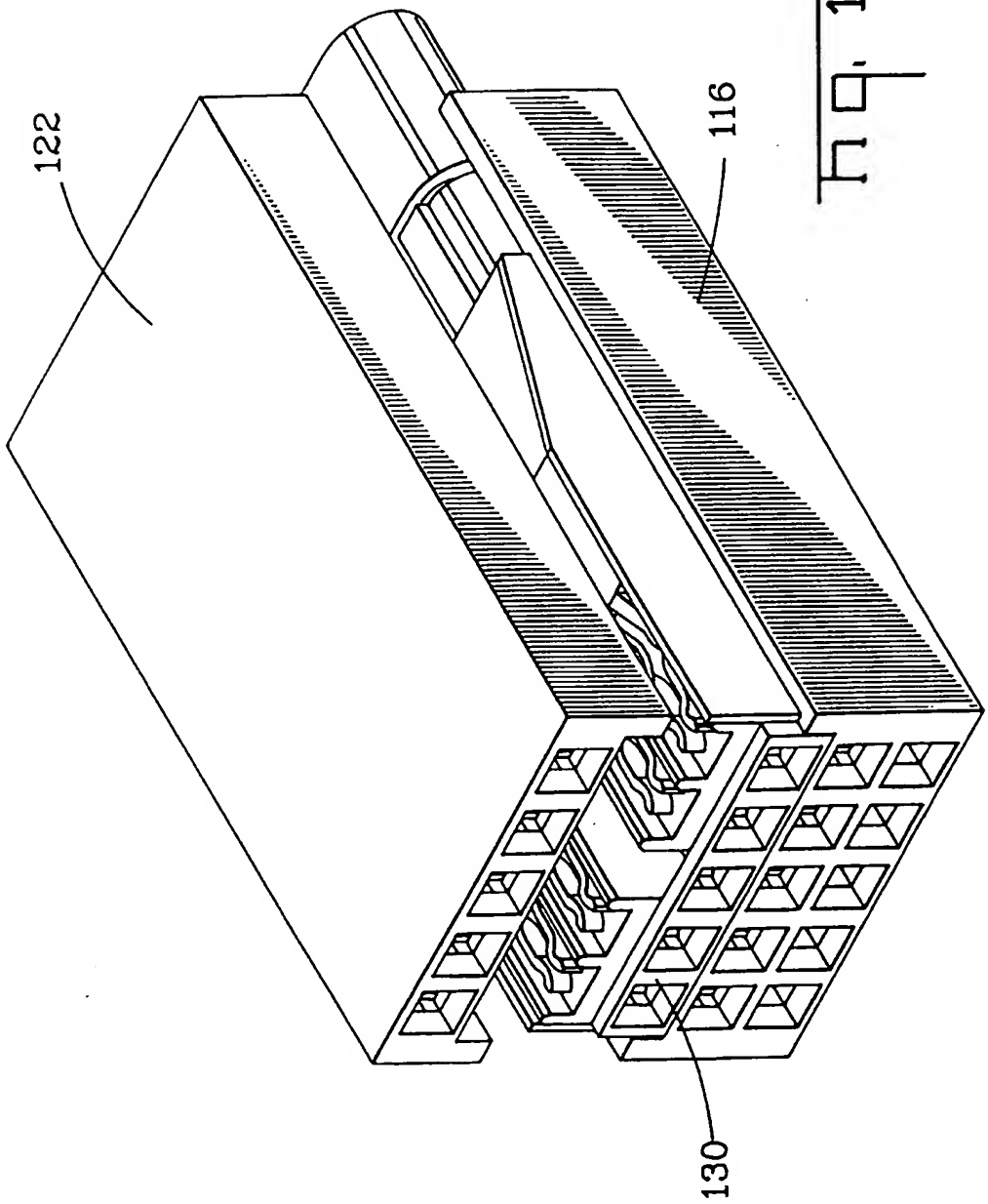


Fig. 16